Remarks/Arguments

These remarks are in response to the Office Action dated September 22, 2004 (hereinafter "Office Action"). This reply is timely filed. At the time of the Office Action, claims 1-20 were pending in the application. Claims 1-7 were rejected under 35 U.S.C. 103(a). Claims 8-20 have been allowed. The rejections are set out in more detail below.

I. Missing Examiner Signatures on IDS and Supplemental IDS

Prior to addressing the Examiner's rejections on the art, Applicants note that the citations identified in the Information Disclosure Statement filed July 7, 2003, and the Supplemental Information Disclosure Statement filed September 5, 2003, do not appear to have been signed by the Examiner. Applicants respectfully request that the Examiner initial the references in said Information Disclosure Statements and consider the references, if the Examiner has not already done so.

It also should be noted that the IDS attached to the Office Action is not one which was submitted by Applicants for the present patent application. Indeed, the first named inventor in the IDS provided by the Examiner is not an inventor of the present invention.

II. Brief Review of Applicants' Invention

A brief review of applicants' invention is appropriate. The present invention relates to a waveguide, which can be a horn antenna, including at least one outer surface defining a waveguide cavity and at least one inner surface positioned within the waveguide cavity. The inner surface includes a frequency selective surface (FSS) having a plurality of FSS elements coupled to at least one substrate. The substrate defines a first propagation medium such that an RF signal having a first wavelength in the first propagation medium can pass through the FSS. The FSS is coupled to a second propagation medium such that in the second propagation medium the RF signal has a second wavelength which is at least twice as long as a physical distance between centers of adjacent FSS elements. This embodiment provides a ratio of wavelength to element spacing which minimizes scattering of electromagnetic energy in uncontrolled directions, thereby virtually eliminating the occurrence of grating lobes which can occur

when typical FSS element spacing is used. (See Applicants' specification, p. 15, ¶ 43 – p.16, ¶ 44). This arrangement also improves FSS performance with respect to RF angles of incidence, which vary significantly from the performance at normal incidence.

Notably, the substrate can comprise materials such as meta-material or liquid crystal polymer (LCP). Notably, the use of these materials in substrate enables tailoring of substrate's electromagnetic properties to an extent not possible with conventional substrate materials. For example, materials having a dielectric constant in the range of 2 to about 2650 can be used.

III. Claim Rejections on Art

Claims 1-7 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,208,316 to Cahill (hereinafter "Cahill"). Cahill discloses a frequency selective surface which separates or combines two channels by using two or three spaced layers of resonant elements. The resonant elements are separated using convention substrate materials, for example glass reinforced PTFE or fused silica.

Amended claim 1 recites an outer surface defining a waveguide cavity and at least one inner surface positioned within said waveguide cavity. The inner surface comprises a frequency selective surface (FSS) having a plurality of frequency selective surface elements coupled to at least one substrate. Claim 1 further recites that the substrate comprises at least one material selected from the group consisting of meta-material and liquid crystal polymer (LCP). Cahill does not teach or suggest this limitation.

The term "meta-material" refers to composite materials formed from the mixing or arrangement of two or more different materials at a very fine level, such as the molecular or nanometer level. Applicants' specification, p. 23, ¶ 64. For example, the meta-material can include nanoparticles. Id at p. 24, ¶ 65. Notably, the use of meta-material within the substrate enables tailoring of substrate's electromagnetic properties. Id at p. 23, ¶ 64. For example, materials having a dielectric constant in the range of 2 to about 2650 can be used. Id at p. 25, ¶ 69. Moreover, the selectable dielectric properties can be localized to specific regions of the substrate as desired. Id at p. 25, ¶ 68.

LCPs are characterized as having liquid crystal states and have a number of unique characteristics that result in physical properties that can be significantly responsive to a variety of energetic stimuli. Id at p. 26, ¶ 74. Indeed, some LCPs are responsive to electric and magnetic fields, and produce differing responses based on the orientation of the applied fields relative to the director axis of the LCP. Id at p. 28, ¶ 79. Accordingly, electrical characteristics of the substrate, for example permittivity, can be selectively controlled. Id at p. 28, ¶ 80. Temperature and photonic radiation also can be used to modify the dielectric properties of the LCP. Id at p. 29, ¶ 82.

IV. Allowable Subject Matter

Applicants' note with appreciation that claims 8-20 have been allowed.

V. New Claim

New claim 21 has been added to recite additional features of applicants' invention which are believed allowable. Specifically, claim 21 recites that the FSS is parallel to an outer wall of the waveguide such that the FSS defines a wall of a second, smaller waveguide within the first waveguide. Such structure is not disclosed in Cahill.

VI. Conclusion

It is believed that all claims are in condition for allowance. Nevertheless, Applicant invites the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. In view of the foregoing remarks, Applicant respectfully requests reconsideration and prompt allowance of the pending claims.

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Amdt. dated November 23, 2004
Reply to Office Action dated: September 22, 2004

Although no fee is believed due, the Commissioner is hereby authorized to charge any fees which may be due by submission of this document to Deposit Account No. 50-2884.

Respectfully submitted,

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Date

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